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Memorandum For: The Record

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Subject: Steller Sea Lion Pup Counts, June-July 2005

An aerial survey to assess Steller sea lion pup production in Alaska (from Dixon Entrance at 133°W to Attu Island at 172°E) was conducted by NMFS from 21 June to 10 July 2005. This was the first, Alaska-wide survey conducted using medium format, vertical photogrammetric techniques to assess Steller sea lion pup production. As in previous years, pups were also counted directly during visits to selected rookeries from the eastern Aleutian Islands (169°W) to Prince William Sound (147°W) during a pup branding and assessment cruise conducted by NMFS from 20 June to 7 July 2005 aboard the US Fish and Wildlife Service RV *Tiglax*. For counting pups, rookery visits have two disadvantages compared to aerial surveys: (1) only a subset of rookeries can be visited each year, precluding an Alaska-wide count; and (2) most adult Steller sea lions are cleared from the rookery beach into the water. The aerial survey conducted in 2005 provided the first Alaska-wide Steller sea lion pup count and with less disturbance on rookeries.

From photographs taken during the 2005 aerial survey, a total of 14,768 Steller sea lion pups were counted on 63 rookery and haulout sites; 5,510 on 9 sites in SE Alaska at the northern end of the range of the eastern stock, and 9,258 on 54 sites in the Alaskan range of the western stock (east of Prince William Sound at 144°W to Attu Island; Table 1; Figures 1 and 2). Two rookeries within the range of the western stock in Alaska on Akun Island (at Billings Head) and on Yunaska Island were not photographed in 2005 because of weather and terrain constraints. However, these rookeries were visited and pups were counted on the 2004 RV *Tiglax* pup cruise.

A total of 3,555 Steller sea lion pups were counted from the beach (or skiff) at 19 sites during the 2005 RV *Tiglax* cruise (Table 1). Sixteen of these 19 sites were also photographed during the aerial survey.

Time series of pup counts at rookeries in 6 regions have been used to determine trends in pup production in the western stock in Alaska (Figure 1). Thirty-one trend rookeries were chosen because of their size (trend rookeries had 89% of the total number pups counted at all western sites in 2005) as well as the consistency of data collection over time. Because not all trend rookeries have been surveyed in a single year prior to 2005, counts were aggregated for multiple years by region (Table 2). In cases where

multiple counts were available from a trend rookery in a single year (medium format photograph and a beach count), the maximum pup count at the site was used. For trend rookery sites missed in 2005 (Billings Head on Akun Island, and Yunaska Island), 2004 counts were used. Thus, a single 2004 count at Akun Island (85 pups) was used in both the 2003/2004 and 2005 eastern Aleutian Islands totals.

Steller sea lion pup production at western stock trend rookeries in the Kenai to Kiska area (Figure 1) declined 40% in the 1990s (Table 2; Figure 3). However, from 2001 to 2005, there were small increases in pup numbers of 4% (+265 pups) at trend rookeries in the Kenai to Kiska area and 3% (+239 pups) across the range of the western stock in Alaska. These recent trends in pup counts, while encouraging, are less than those observed in non-pup counts from 2000 to 2004, which increased between 10% and 18% depending on the group of sites chosen (Fritz and Stinchcomb 2005). More research is necessary to determine if this due to declines in fecundity (Holmes and York 2003) or changes in the age structure of the Steller sea lion population (e.g., greater proportion of juveniles).

There were strong spatial differences in the recent trends in pup counts, suggesting that the magnitude or number of factors affecting the western stock of Steller sea lions also varied regionally (Figure 3). Large increases of over 20% were observed in the eastern Gulf of Alaska (+129 pups) and eastern Aleutian Islands (+360 pups), while a smaller increase of only 2% (+36 pups) was seen in the western Gulf of Alaska. The largest decline in pup counts (30% or -145 pups) occurred in the western Aleutian Islands, while smaller declines were observed in the central Gulf of Alaska (4% or -70 pups) and central Aleutian Islands (2% or -61 pups). The time series of regional aggregate pup counts (Figure 3) suggests that annual pup production has been stable since 2001 in 4 of the 6 regions: each of the three Gulf of Alaska regions and the central Aleutian Islands. In the remaining two regions, pup counts have been increasing since 1998 in the eastern Aleutian Islands, but were the smallest on record at the four rookeries in the western Aleutian Islands.

Counts of Steller sea lion pups on Walrus Island (near St Paul Island in the Pribilof Islands) in 2005 were also the smallest on record. Several hundred pups were born each year on Walrus Island in the late 1980s (Table 2), but even these levels represented a nearly 90% decline from 1960, when 2,866 pups were born. By the early 1990's, annual pup production dropped under 100 at Walrus Island, and this decline has continued through 2005, when fewer then 30 were counted.

The SE Alaska sites were surveyed from the air most recently in 2002, when a total of 4,866 pups were counted. The 2005 total of 5,510 represents an increase of 13% in 3 years at the 9 locations surveyed (Table 1). The largest Steller sea lion rookery in the world is located in SE Alaska at the Forrester complex, where a total of 3,429 pups were counted on 5 sites, which is over 20% of all pups counted from Dixon Entrance to Attu Island in Alaska in 2005. The largest single site was Lowrie Island within the Forrester complex, where an estimated 1,508 pups were born (10% of the Alaskan total).

Literature Cited

Fritz, L. W., and C. Stinchcomb. 2005. Aerial, ship, and land-based surveys of Steller sea lions (Eumetopias jubatus) in the western stock in Alaska, June and July 2003 and 2004. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-153, 56 p.

Holmes, E. E., and A. E. York. 2003. Using age structure to detect impacts on threatened populations: a case study with Steller sea lions. Conservation Biology 17: 1794-1806.

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Table 1. Number of Steller sea lion pups counted on terrestrial sites in Alaska in June-July 2005. Counts from medium-format photographs taken during an aerial survey and from direct observation on the beach or from a skiff are shown, along with the maximum count at each site. Sites are arranged by genetic stock (eastern and western) and categorized by region (SEAK=southeast Alaska; EGOA, CGOA, WGOA=eastern, central and western Gulf of Alaska; EAI, CAI, WAI=eastern, central and western Aleutian Islands; BERING=eastern Bering Sea) and type (R=rookery; H=haulout). Site names in bold font are rookeries used for trend analysis.

| | | | Aerial Survey | | | Beach or Skiff | | | | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|
| Site Name | Region | Type | Month | Day | Pups | Month | Day | Pups | Comment | # of Pups |
| Eastern Stock | | | | | | | | | | |
| WHITE SISTERS | SE AK | R | 7 | 10 | 520 | | | | | 520 |
| BIALI ROCK | SE AK | R | 7 | 10 | 100 | | | | | 100 |
| HAZY | SE AK | R | 7 | 10 | 1,286 | | | | | 1,286 |
| FORRESTER/SEA LION RK | SE AK | R | 7 | 10 | 533 | | | | | 533 |
| FORRESTER/EAST RK | SE AK | R | 7 | 10 | 134 | | | | | 134 |
| FORRESTER/NORTH | SE AK | R | 7 | 10 | 951 | | | | | 951 |
| FORRESTER/C HORN RK | SE AK | R | 7 | 10 | 303 | | | | | 303 |
| FORRESTER/LOWRIE | SE AK | R | 7 | 10 | 1,508 | | | | | 1,508 |
| GRAVES ROCK | SE AK | R | 7 | 10 | 175 | | | | | 175 |
| Western Stock | | | | | | | | | | |
| **SEAL ROCKS** | EGOA | R | 6 | 21 | 508 | 7 | 2 | 556 | | 556 |
| **WOODED (FISH)** | EGOA | R | 6 | 21 | 96 | 7 | 3 | 159 | | 159 |
| CHISWELL ISLANDS | EGOA | H | 6 | 21 | 44 | | | | | 44 |
| **OUTER (PYE)** | CGOA | R | 6 | 21 | 104 | | | | | 104 |
| **SUGARLOAF** | CGOA | R | 6 | 21 | 559 | | | | | 559 |
| USHAGAT | CGOA | H | 6 | 21 | 55 | | | | | 55 |
| SEA OTTER | CGOA | H | | | | 6 | 30 | 1 | | 1 |
| LATAX ROCKS | CGOA | H | | | | 6 | 30 | 1 | skiff | 1 |
| **MARMOT** | CGOA | R | 6 | 23 | 433 | | | | | 433 |
| TWOHEADED | CGOA | H | 6 | 23 | 16 | 6 | 29 | 1 | skiff | 16 |

| Table 1 (continued). | | | Aerial Survey | | | Beach or Skiff | | | | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|
| Site Name | Region | Type | Month | Day | Pups | Month | Day | Pups | Comment | # of Pups |
| **CHOWIET** | CGOA | R | 6 | 23 | 432 | 6 | 28 | 309 | | 432 |
| **CHIRIKOF** | CGOA | R | 6 | 23 | 123 | | | | | 123 |
| NAGAI ROCKS | CGOA | H | 6 | 23 | 31 | | | | | 31 |
| | | | | | | | | | | |
| LIGHTHOUSE ROCKS | WGOA | H | 6 | 23 | 11 | 6 | 28 | 5 | skiff | 11 |
| **ATKINS** | WGOA | R | 6 | 23 | 328 | 6 | 27 | 75 | skiff | 328 |
| **CHERNABURA** | WGOA | R | 7 | 9 | 153 | 6 | 27 | 115 | skiff | 153 |
| THE WHALEBACK | WGOA | H | 6 | 23 | 24 | 6 | 27 | 23 | skiff | 24 |
| JUDE | WGOA | H | 6 | 23 | 168 | 6 | 26 | 206 | | 206 |
| SUSHILNOI ROCKS | WGOA | H | 6 | 25 | 12 | | | | | 12 |
| **PINNACLE ROCK** | WGOA | R | 6 | 25 | 643 | | | | | 643 |
| **CLUBBING ROCKS** | WGOA | R | 6 | 25 | 528 | 6 | 25 | 583 | | 583 |
| SOUTH ROCKS | WGOA | H | 7 | 9 | 44 | | | | | 44 |
| | | | | | | | | | | |
| SEA LION ROCK (AMAK) | EAI | R | 6 | 23 | 158 | | | | | 158 |
| **UGAMAK/NORTH** | EAI | R | 6 | 25 | 404 | 6 | 23 | 426 | | 426 |
| **UGAMAK/UGAMAK BAY** | EAI | R | 6 | 25 | 239 | 6 | 24 | 298 | | 298 |
| **UGAMAK/ROUND** | EAI | R | 6 | 25 | 44 | 6 | 24 | 45 | | 45 |
| **AKUTAN/CAPE MORGAN** | EAI | R | 6 | 25 | 485 | 6 | 22 | 657 | | 657 |
| **AKUN/BILLINGS HEAD*** | EAI | R | | | | | | 85 | in 2004 | 85 |
| UNALASKA/CAPE IZIGAN | EAI | H | 7 | 9 | 21 | | | | | 21 |
| **BOGOSLOF** | EAI | R | 6 | 23 | 225 | | | | | 225 |
| OGCHUL | EAI | R | 7 | 9 | 78 | 6 | 21 | 65 | | 78 |
| ROOTOK/NORTH | EAI | H | | | | 6 | 22 | 1 | | 1 |
| **ADUGAK** | EAI | R | 7 | 9 | 185 | | | | | 185 |
| | | | | | | | | | | |
| **YUNASKA*** | CAI | R | | | | | | 145 | in 2004 | 145 |
| **SEGUAM/SADDLERIDGE** | CAI | R | 6 | 28 | 530 | | | | | 530 |
| AGLIGADAK | CAI | R | 7 | 9 | 0 | | | | | 0 |
| SEGUAM/TURF POINT | CAI | H | 7 | 9 | 7 | | | | | 7 |
| AMLIA/SVIECH. HARBOR | CAI | H | 7 | 9 | 28 | | | | | 28 |

| Table 1 (continued). | | | Aerial Survey | | | Beach or Skiff | | | | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|
| Site Name | Region | Type | Month | Day | Pups | Month | Day | Pups | Comment | # of Pups |
| **KASATOCHI** | CAI | R | 6 | 28 | 372 | | | | | 372 |
| **ADAK/LAKE POINT** | CAI | R | 7 | 8 | 311 | | | | | 311 |
| **ADAK/CAPE YAKAK** | CAI | H | 7 | 8 | 0 | | | | | 0 |
| KANAGA/SHIP ROCK | CAI | H | 7 | 6 | 221 | | | | | 221 |
| **GRAMP ROCK** | CAI | R | 7 | 6 | 387 | | | | | 387 |
| **TAG** | CAI | R | 7 | 6 | 144 | | | | | 144 |
| **ULAK/HASGOX POINT** | CAI | R | 7 | 8 | 338 | | | | | 338 |
| SEMISOPOCHNOI/POCHNOI | CAI | R | 7 | 8 | 16 | | | | | 16 |
| AMCHITKA/EAST CAPE | CAI | R | 7 | 8 | 24 | | | | | 24 |
| **AMCHITKA/COLUMN ROCK** | CAI | R | 7 | 5 | 44 | | | | | 44 |
| **AYUGADAK** | CAI | R | 7 | 5 | 83 | | | | | 83 |
| **KISKA/CAPE ST STEPHEN** | CAI | R | 7 | 5 | 82 | | | | | 82 |
| **KISKA/LIEF COVE** | CAI | R | 7 | 5 | 115 | | | | | 115 |
| **BULDIR** | WAI | R | 7 | 8 | 26 | | | | | 26 |
| ALAID | WAI | H | 7 | 2 | 27 | | | | | 27 |
| **AGATTU/CAPE SABAK** | WAI | R | 7 | 2 | 113 | | | | | 113 |
| **AGATTU/GILLON POINT** | WAI | R | 7 | 2 | 157 | | | | | 157 |
| **ATTU/CAPE WRANGELL** | WAI | R | 7 | 8 | 47 | | | | | 47 |
| AIKTAK | WAI | H | 6 | 25 | 8 | | | | | 8 |
| WALRUS | BERING | R | 6 | 27 | 27 | 7 | 26 | 29 | | 29 |
| ST. PAUL/SEA LION ROCK | BERING | H | 6 | 27 | 0 | | | | | 0 |

Table 2. Counts of Steller sea lion pups at selected rookeries (bold in Table 1) in seven sub-areas of the western stock in Alaska from 1985-89 to 2005. The maximum count during each period at the selected rookeries (n) was used. Blank cells indicate incomplete counts in the period and sub-area. Percentage change in counts between periods is also shown. Data prior to 2005 were from Fritz and Stinchcomb (2005). EBS=Eastern Bering Sea.

| | Gulf of Alaska | | | Aleutian Islands | | | | EBS | Western |
|---|---|---|---|---|---|---|---|---|---|
| Period | Eastern n = 2 | Central n = 5 | Western n = 4 | Eastern n = 5 | Central n = 11* | Western n = 4 | Kenai to Kiska | Walrus Island | Stock in Alaska |
| 1985-1989 | | 10,254 | | 4,778 | 9,428 | | | 250 | |
| 1990-1992 | | 4,904 | 1,923 | 2,115 | 3,568 | | 12,510 | 63 | |
| 1994 | 903 | 2,831 | 1,662 | 1,756 | 3,109 | | 9,358 | 61 | |
| 1997 | 611 | | | | | 979 | | 35 | |
| 1998 | 689 | 1,876 | 1,493 | 1,474 | 2,834 | 803 | 7,677 | | 9,169 |
| 2001-2002 | 586 | 1,721 | 1,671 | 1,561 | 2,612 | 488 | 7,565 | 39 | 8,678 |
| 2003-2004 | 716 | 1,609 | 1,577 | 1,731 | | | | | |
| 2005 | 715 | 1,651 | 1,707 | 1,921 | 2,551 | 343 | 7,830 | 29 | 8,917 |
| Percent Change | | | | | | | | | |
| 1985-89 to 2001-2002 | | -83% | | -67% | -72% | | | -84% | |
| 1990-92 to 2001-2002 | | -65% | -13% | -26% | -27% | | -40% | -38% | |
| 2001-2002 to 2005 | 22% | -4% | 2% | 23% | -2% | -30% | 4% | -25% | 3% |

* 1985-89 CAI count does not include Amchitka/Column Rocks (n = 10).

Figure 1. Steller sea lion survey regions from Dixon Entrance to Attu Island and the location of the principal rookeries in Alaska. Kiska Island, the Kenai Peninisula, and Walrus Island in the eastern Bering Sea are also noted, along with the boundary between the breeding ranges of the eastern and western sea lion stocks.

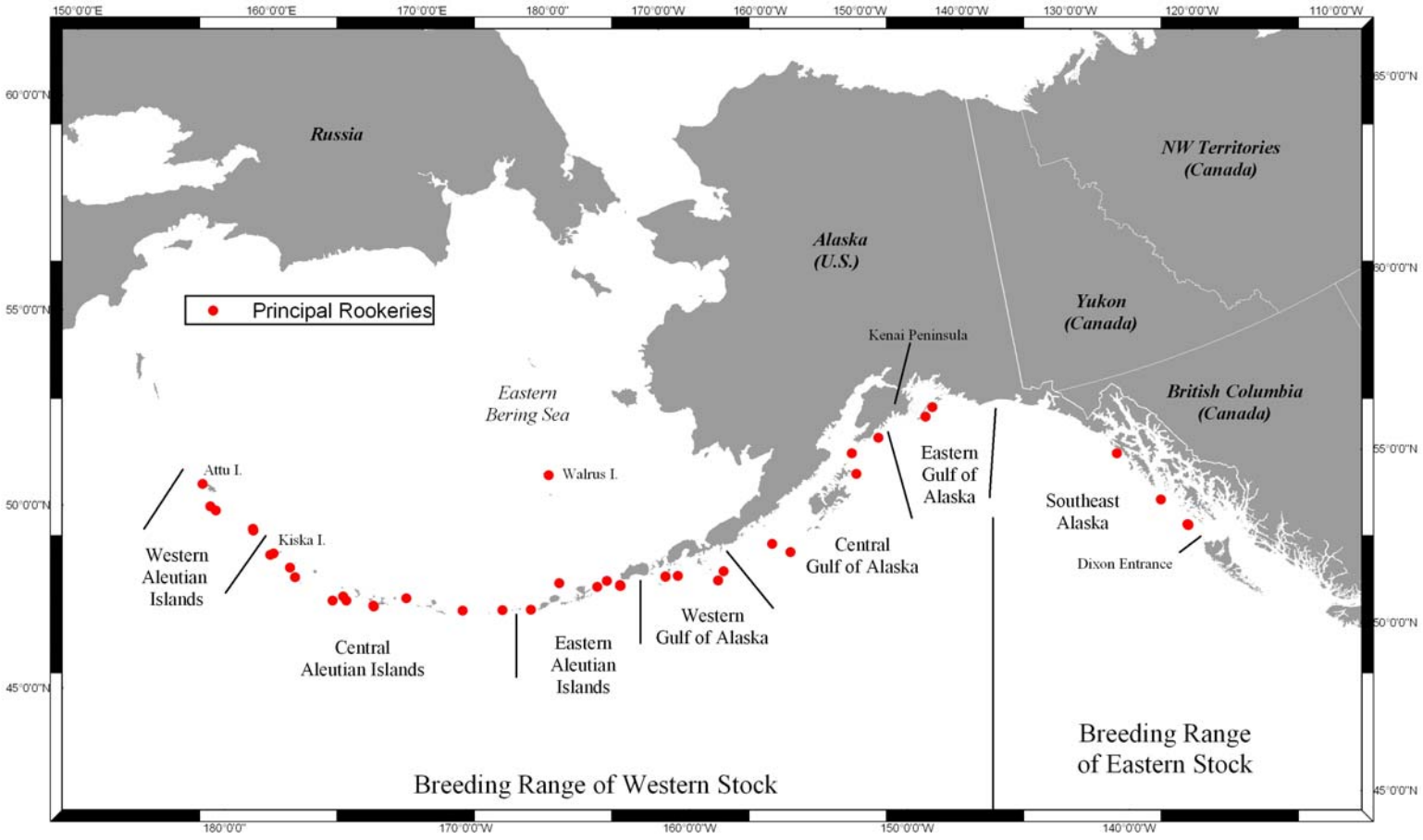

Figure 2. Detail of a medium-format aerial photograph of the Steller sea lion rookery on Atkins Island taken on 23 June 2005. Examples of four size-age classes of sea lions are circled: pups (blue), juvenile (yellow), adult females (purple), and adult males (bulls; red).

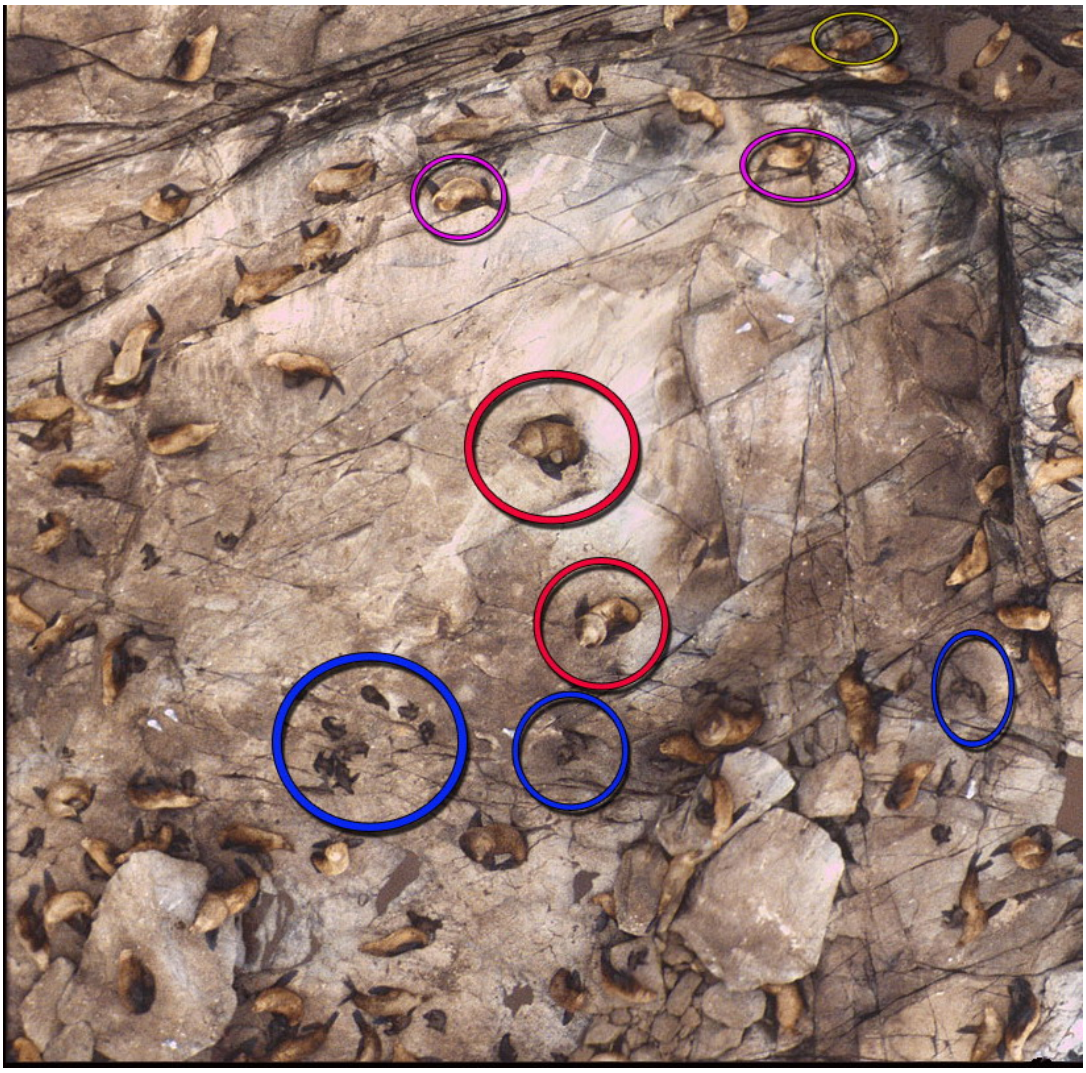

Figure 3. Steller sea lion pup counts at trend rookeries in the range of the western stock in Alaska by region from the late 1980s to 2005 in the Gulf of Alaska (A) and Aleutian Islands (B). Percent change in counts between 1990/92 and 2001/02 (C) and 2001/02 and 2005 (D) are also shown (data from Table 2).